On a collection of Sipunculids from Indian waters

BY

PEACE JOHNSON

(Department of Zoology, Christ College, Irinjalakuda)

(With four plates)

INTRODUCTION

Prashad (1937) reported five sipunculids from Indian waters, namely *Sipunculus nudus* Linn., *S. robustus* Keferstein, *S. porrectus* Selenka, *S. aequabilis* Sluiter and *Siphonosoma australe* (Keferstein). Recently (1964, 1969) I have reported two species of *Aspidosiphon*, *A. homomyarium* Johnson, *A. exostomum* Johnson and a species of *Xenosiphon*, *X. indicus* Johnson. Except for these eight species there have been no other records of sipunculids from Indian Seas. The present paper describes four species of the genus *Phascolosoma* Leuckart of which two are new and a single species of the genus *Phascolopsis* Fisher. Since this is the first record of the species of *Phascolosoma* and *Phascolopsis* from the Indian Seas, all have been described in detail. The diagnostic generic characters are also given.

Genus *PHASCOLOSOMA* Leuckart 1828

Phascolosoma Leuckart, 1828, p. 22; Baird, 1868, p. 82.
Phymosomum Quatrefagus, 1866, p. 621.
Prophymosoma Lambert, 1900, p. 54.
Physconosoma Bather, 1900, p. 78.
Phymosoma Selenka, Bulow & de Man, 1883, p. 54; Ikeda, 1904, p. 20.
Physcosoma Selenka, 1897, p. 460; Shipley, 1903, p. 174; Lanchester, 1905, p. 28; Gerould, 1913, p. 419; Sato, 1939, p. 38.
Phascolosoma Fisher, 1950, p. 551; 1952, p. 422; Wesenberg-Lund, 1954b, pp. 1-18; Edmonds, 1955, p. 28.

Diagnosis :

Moderate as well as very large forms. Tentacles not encircling mouth, forming crown dorsal to mouth opening. Introvert when extended set at same axis as that of body. Skin externally beset

with very conspicuous papillae. Papillae usually more crowded and deep in colour at the base of introvert and posterior region of the body. Papillary pore surrounded by chitinous plates of different size and shape. Hooks, when present, arranged in circlets at anterior part of introvert; characterised with bent point and clear streak running through centre, with or without accessory points. In certain cases, besides clear streak, a triangular clear area also present. Longitudinal muscle layer of body wall forms longitudinal bands. Nephridia two in number and retractor muscles four basially, sometimes two, uniting in various ways to form single or double bands. Spindle muscle forming axis for intestinal coils, and attached posteriorly to body wall. Pollian sac generally simple, sometimes with tubercle-like villi projecting into coelom.

Phascolosoma antillarum Grube & Oersted, 1859

(Pl. IV, Figs. 6-11; Pl. II, Figs. 10-12)

Phascolosoma antillarum Grube & Oersted, 1859, p. 117.
Phascolosoma fuscum Keferstein, 1862, p. 67.
Sipunculus (*Phymosomum*) *antillarum* Quatrefagus, 1865, p. 626.
Phascolosoma nigreceps Baird, 1868, p. 90.
Phymosoma antillarum Selenka *et al.* 1883, p. 57; Fischer, 1895, p. 12; Augner 1903, pp. 297-371; Ikeda, 1904, p. 24.
Physcosoma antillarum Gerould, 1913, p. 420.
Phascolosoma antillarum Fisher, 1952, p. 434.

Present record :

Port Blair (Andaman Island).

Distribution :

Florida, West Indies, Columbia, Venezuela, Dutch Guiana, Brazil, Gulf of California, Costa Rica, Panama, Chile, Hawaii, Riukiu Islands & Jamaica.

Description :

Thick-walled, medium-sized sipunculid. The length of the trunk varies from 26 to 29 mm. and that of the introvert from 6 to 9 mm. Maximum width of the body varies from 6 to 8 mm. The shape resembles that of a bottle with a round posterior end (Pl. IV, Fig. 6) and a narrow introvert (Pl. IV, Fig. 7). The colour may be greyish black or dirty dark brown. The body papillae are very conspicuous, dark brown in colour, sparingly scattered all over the body and more crowded at the base of the introvert and at the posterior part of

the body. In the middle region of the trunk they are flat and the papillary pore is immediately surrounded by a clear space which is encircled by a ring of large and closely packed chitinous plates of irregular shape (Pl. II, Figs. 10 & 11). At the base of the introvert and at the posterior region of the body the papillae are slightly raised and there are few more rows of closely packed, polygonal and medium-sized chitinous plates circling them besides the ring of larger plates (Pl. II, Fig. 12). These keep the papillary pore slightly raised from the body surface. At the anterior region of the introvert (Pl. IV, Fig. 8), papillae are much raised, conical and spine-like, with a pore at the centre and these are formed of chitin which is homogeneous instead of being in plates. Chitinous granules occur in the skin between papillae. Hooks on the introvert absent. Tentacles numerous, filamentous and form a crown dorsal to the mouth opening. Crown is semicircular and the tentacles are arranged in more than one row. Tentacles are striped with alternating dark and white bands (Pl. IV, Fig. 11). Nuchal organ, if present, is inconspicuously developed. A thickened ridge surrounds the crown as well as the mouth opening. Immediately behind this ridge a small region of the introvert is white in colour and smooth without any papillae.

Longitudinal muscle layer of the body wall separated into bands which frequently anastomose. Anteriorly, the bands number from 13 to 15 and posteriorly from 37 to 40. Retractor muscles four, dorsal and ventral, originating at the same transverse line. Immediately after their origin the dorsal and ventral of one side fuse to form a stout band. Nephridia are long and reach farther than the middle of the trunk. Two-thirds of its length is fixed to the body wall by mesenteries. Oesophagus is short and the intestinal coils vary from 16 to 20 which spiral round a spindle muscle that arises near the anus and is attached to the posterior part of the body. Rectum is long and without a rectal caecum. A single intestinal fastener which arises from the ventral wall, left of the nerve cord, is attached to the last whorl of the intestine. Pollian sac extends along the oesophagus and has small tubercle-like villi (Pl. IV, Fig. 10). Posteriorly the rectum is fixed to the body wall by a well developed wing muscle. Nephridial openings are below the anal opening. In the specimens dissected eggs were present in the coelom.

Remarks:

In Selenka's (1897) account the intestinal fastener is described as attached to the first whorl of the intestine instead of the last whorl of the intestine as in these specimens. Again, Selenka as well as Gerould

(1913) describe the nephridia as fixed to the body wall by their entire length, but in the Indian forms it is fixed only by the two-thirds of their length. Selenka has counted about 50 to 80 tentacles. Fisher (1952) has counted about 200 tentacles arranged in a fashion that is found in *Dendrostomum* species. In all my specimens the tentacles are arranged in more than one row, but in the form of a semicircle above the mouth forming almost the shape of the letter W (Pl. IV, Fig. 9).

Phascolosoma agassizii Keferstein

(Pl. III, Figs. 1 to 5)

Phascolosoma agassizii Keferstein, 1866, p. 218; 1867, p. 46.
Phymosoma agassizii Selenka, 1883, p. 78.
Physcosoma agassizii Chamberlin, 1919, p. 30.
Phascolosoma lordi Baird, 1868, p. 92.

Present Record :

50 specimens from Okha (Gulf of Kutch).

Distribution :

Kodiak Island, Alaska, San Quintin, Baja California, British Columbia, Ceylon, Laccadive and Maldive Islands, Mauritius, Sumatra, Timor, Sharks Bay, Rottnest Island, Western Australia, Sydney, Java Sea, Tahiti, Bermuda and Villefranche.

Description :

Trunk varies in length from 45 to 55 mm. Introvert distinctly narrower than the trunk, 14 to 17 mm. in length (Pl. III, Fig. 1). Skin opaque to translucent, pinkish grey, yellowish grey, reddish brown or dark muddy brown in colour. Introvert carries dark transverse bands, usually over its entire length, sometimes at its distal end only. These do not meet ventrally. Body beset with papillae appearing as dark spots in contrast to the skin colour. Papillae are crowded at the base of the introvert and the posterior region of the body. Papillae are large, conical and greatly raised from the body surface. The papillary pore is surrounded by a few irregular inner rows of large chitinous granules and numerous outer rows of smaller chitinous granules (Pl. III, Fig. 5). Papillae in the middle part of the trunk and the introvert proper are smaller and less conical, though structurally similar to those present at the base of the introvert. Everywhere the size of the papillae gradually decreases from the dorsal to the ventral side of the animal. The introvert at its anterior end carries 15 to 17 circlets of hooks (Pl. III, Fig. 4). Hooks are

small and characterised by a slightly curved apex, which is not uniform (Pl. III, Figs. 2 & 3). Also the diameter of the hook-base varies within the same individual. Each hook is provided with a centrally running narrow streak without any expansion at the base. Triangular clear area is absent for the hook. Anterior to these hook-circlets there is a small region on the introvert where hooks or papillae are absent. The introvert ends in a thickened ridge which encircles the mouth and the tentacular crown. Tentacular crown is semicircular and dorsal to the mouth. There are 20 to 35 filiform tentacles (Pl. III, Fig. 4).

Internally the longitudinal muscle layer is separated into longitudinal bands, about 18 to 22 bands anteriorly and 24 to 30 posteriorly. Four retractor muscles, the ventral pair reaching the posterior third of the body. About 6 to 7 longitudinal muscle bands take part in the formation of the ventral while 4 to 7 bands make the dorsal. The attachment of the dorsal pair to the body wall is anterior to that of the ventral pair. Two long nephridia, both opening out ventrally at the same level, a little posterior to the anal opening. They are attached to the body wall by mesenteries along their entire length. The spindle muscle, which takes its origin near the anus, runs along the length of the rectum to pass through the centre of the intestinal coils and is firmly attached to the posterior extremity of the trunk. The oesophagus is fairly long and carries with it at its dorsal side the poorly developed and simple pollian sac. The intestinal coils vary from 14 to 16 and the rectum is a straight tube opening out by the anus. A rectal caecum is absent. The last part of the rectum is fixed to the body wall by the wing muscle. The entire alimentary canal is suspended in the coelom by a single intestinal fastener which arises from the midventral line of the body wall, anterior to the dorsals, by two roots and at its distal end it again bifurcates, one limb being attached to the rectum and the other to the first whorl of the intestine. Eggs are present in the coelom of most of the specimens dissected.

Remarks :

The specimens in my collection resemble the description of the Californian specimens described by Fisher (1952). I could count a maximum 17 rows of hooks only while Fisher has given the maximum number as 25. There are about 35 tentacles in the Indian forms while Fisher has counted only 24 tentacles for the American forms. The variation noticed by Fisher in the curvature of the hooks and the hook base has been noticed in the Indian forms also.

Phascolosoma spinosum sp. nov.

(Pl. II, Figs. 1 to 9)

Present record :

5 specimens from Port Blair (Andaman Islands).

Description :

This species is a cylindrically elongated from with the posterior tip tapering to a point (Pl. II, Fig. 1). Body wall thin enough to show the longitudinal bands. Colour yellowish brown. Introvert shorter and distinctly narrower than the trunk. The trunk varies in length from 57 to 58 mm. and the introvert from 28 to 29 mm. The maximum width of the body varies from 4 to 5 mm.

Skin beset with conspicuous papillae, crowded at the base of the introvert and to a lesser extent at the posterior part of the body. They appear as dark brown spots, rounded in shape and are slightly raised from the body. Papillae at the posterior part of the body are larger. The papillary pore is surrounded by a small clear area and then by numerous small chitinous granules which are closely packed (Pl. II, Figs. 7, 8 & 9). In the middle region of the body the papillae are sparingly distributed and are smaller and less raised. The nature of the papillary structure is the same as present at the posterior part of the body. On the introvert proper they are still smaller, but do not differ in their structure. At the base of the introvert, in between the crowded papillae, there are spine-like papillae which are confined to the dorsal side of the introvert. At the apex of these papillary spines (apices are directed posteriorly) there are papillary openings. About 25 to 30 such papillary spines have been counted. On the introvert there are a number of pigment bands, dark in colour, which do not meet on the ventral side. At the anterior region of the introvert there are 17 to 20 rows of hooks. Hooks are characterised by sharply bent apex (at right angle to the base) with a clear streak which bends strongly towards the inner tip of the base on the concave side of the hook. On the convex side near the base there is a clear triangular area. The base of the hook is comparatively small while the hook is tall and high. Between the hook rows small perforated papillae are present. There are 11 finger-shaped tentacles arranged in a row forming a semicircular crown dorsal to the mouth. This tentacular crown is open dorsally where it accommodates the nuchal organ (Pl. II, Fig. 5). On the inner side of the crown the tentacular bases have a greenish tinge. A thickened ridge encircles the mouth and the tentacular crown. This ridge or

collar is broken dorsally where the nuchal organ is present. Posterior to this collar a small region of the introvert is smooth and white where neither hooks nor papillae are present. A thin round membraneous fold of skin projects from the posterior border of this smooth region. The anus is carried on an anal cone.

Internally the longitudinal muscle layer is separated into longitudinal bands which anastomose profusely. There are 16 to 18 bands anteriorly while posteriorly there are 21 to 22 bands. In the middle region the number varies from 23 to 25. There are, therefore, both division and fusion of the bands. Oesophagus is long and about half of it is loosely attached to the retractors by mesenteries (Pl. II, Fig. 2). The pollian sac is simple and extends to about three-fourths of the oesophageal length. There are approximately 35 coils of intestine, the coils being closely wound round a spindle muscle. This spindle muscle originates near the anus and is attached to the body wall posteriorly. Rectum is fairly long without a rectal caecum. There are two intestinal fasteners of which one is bifurcated and attached to the first and second whorls of the intestine. The other is attached to the last whorl of the intestine. There are four retractor muscles which reach the middle of the posterior half of the trunk (Pl. II, Fig. 2). The origin of the dorsal retractors is anterior to that of the ventrals. Immediately after their origin the dorsal and the ventral of one side fuse to form a stout band. The two nephridia are long and reach the base of the retractors. Two-thirds of their length is fixed to the body wall by mesenteries. Nephrostome is small and flower-like and is at the anterior region of the nephridium (Pl. II, Fig. 6). Both the nephridia open at the same level of the trunk, but slightly posterior to the anal opening. Eggs are seen in the coelom.

Systematic position :

P. dentigerum (Selenka & de Man) is perhaps the only species in which there are papillary spines at the base of the introvert. The present species differs from *dentigerum* in the nature of the papillae, retractor muscle and hooks. In *spinosum* the hooks are longer with a comparatively short base and a sharply bent apex. The clear streak is deflected to the inner tip of the base on the concave side of the hook. In *dentigerum* the papillary spines occur at the posterior region of the trunk also while in *spinosum* they are absent at the posterior region of the trunk.

The species is considered to be new on the basis of the hook structure and the nature of the papillae and the retractors.

Holotype and paratypes :

Deposited in the Zoological Museum of B.I.T.S., Pilani, Rajasthan.

Type locality :

Port Blair (Andaman Island).

Phascolosoma andamanensis sp. nov.

(Pl. I, Figs. 1 to 7)

Present record :

160 specimens were collected from Port Blair (Andaman Island).

Description :

A slender, medium-sized, form. The skin may be thick or thin. The posterior tip tapers to a point. The introvert is shorter and narrower than the trunk (Pl. I, Fig. 1). There are dark pigmented bands on the dorsal side of the introvert. Ventrally they are not continuous. The skin may be smooth except at the base of the introvert and the posterior region of the trunk where large, raised and dark brown papillae occur. They are more crowded and coloured at the base of the introvert than at the posterior region. The middle region bear papillae (Pl. I, Fig. 7) which can be observed only under magnification. The papillary pore is at the centre of a clear area which in turn is surrounded by minute chitinous granules. A considerable area in the outer margin of the papilla is devoid of these chitinous granules. Papillae in the middle region of the body do not have any chitinous granules surrounding them. There are hooks which are arranged in circlets at the anterior region of the introvert. These circlets vary in number from 17 to 26. The hook is characterised by broad base and sharply bent apex (at right angle to the base) with a clear streak at the centre which expands at the base considerably and with a triangular clear area at the convex side of the base (Pl. 1, Figs. 5 & 6). In some hooks a characteristic hump can be observed on the concave side, at the bend. In between the hook circlets there are minute perforated papillae arranged in single circular rows. The introvert carries at its tip 11 to 20 fleshy and finger-shaped tentacles which form a horse-shoe-shaped crown placed dorsal to the mouth. This crown encloses at its dorsal side the nuchal organ (Pl. I, Fig. 3). In many specimens a greenish tinge can be observed on the inner side of the tentacles. The ventral mouth and the dorsal tentacular crown are surrounded by a thick ridge in the form of a collar which

is broken dorsally by the nuchal organ. Posterior to this collar a small region of the introvert is creamy white in colour and smooth without papillae and hooks (Pl. I, Fig. 4). In between this smooth region and the hook circlets there is another collar which projects out as a membraneous flap.

Internally, the longitudinal muscle layer is separated into bands. There are 16 to 18 bands anteriorly, 19 to 23 in the middle and 18 to 20 posteriorly. The bands, therefore, divide and fuse at different levels. Oesophagus is long and narrow. Intestinal coils vary from 11 to 17. The rectum is comparatively short and without a rectal caecum (Pl. I, Fig. 2). The single intestinal fastener is delicate and it originates from the ventral wall near the nerve cord and is attached to the beginning of the rectum. It will be missed unless the specimen is carefully examined. A spindle muscle takes its origin near the anus and runs posteriorly forming the axis for the intestinal coils. Posteriorly this muscle is attached to the body wall. Well developed wing muscle fixes the last part of the rectum to the body wall. The pollian sac is dorsal to the oesophagus. At certain places it swells up to form tubercles, probably due to concentrations of coelomic corpuscles at those places. Nephridia are long and tubular reaching one-third of the trunk length. The nephridia are fixed to the body wall by mesenteries by two-thirds of their length. The nephrostome is small and is at the anterior region of the nephridium. There are four retractors. The dorsals are slender and emerge from a place anterior to the stout ventrals. The place of origin of ventrals varies in different individuals. Usually they reach the middle part of the body sometimes a little ahead or little behind. At the anus level, the dorsal and the ventral of one side fuse to form a single stout band. In the introvert these fused bands are held together by mesenteries to appear as a single unit. On the dorsal aspect of this retractor-unit the oesophagus runs down. Eggs were present in the coelom of many specimens dissected.

Systematic position:

This species resembles *P. albolineatum* (Baird) in the hook structure and the papillary arrangement. However, the hooks of this species differ from that of *albolineatum* in lacking a bar with warts at the hook base (Sato 1939). The species resembles *P. varians* (Keferstein) in having the hook bent at right angle to the base and also in the papillary structure and distribution. However, in *varians* between the hook circlets there is a zone where hooks and papillae occur together. This zone is wanting in *andamanensis*. The introvert is longer than

the trunk in *varians* while it is shorter or equal in *andamanensis*. Again from the diagram given by Sato (1939, p. 392) of the hook of *varians* it appears that the triangular clear area in the hook is on the concave side while it is on the convex side in *andamanensis*. There is difference in the number of hook circlets as well as in the number and attachment of the intestinal fasteners.

Considering the hook structure as well as the distribution and composition of papillae, the individuals in my collection have been referred to a new species.

Holotype and paratypes :

Deposited in the Zoological Museum of B.I.T.S., Pilani, Rajasthan.

Type locality :

Port Blair (Andaman Island).

Genus *PHASCOLOPSIS* Fisher, 1950

Diagnosis :

Large, slender and elegant forms. Tentacles filiform, usually very distinct, surrounding mouth in one or two rows or in series of double rows. Hooks absent on introvert. Nuchal organ well developed. Longitudinal muscle layer of trunk wall separated into longitudinal bands. Four retractor muscles. Pollian sac simple. Spindle muscle not extending beyond intestinal loop. Nephridia two only, hang freely in the coelom.

Phascolopsis gouldii (Pourtales 1851)

(Pl. III, Figs. 6 to 11)

Sipunculus gouldii Pourtales, 1851, p. 40.
Phascolosoma gouldii Diesing, 1851, p.588; Baird, 1868, p. 85; Keferstein, 1865, p. 205.

Present record :

6 specimens were collected from Port Blair (Andaman Island) and 3 from Gulf of Mannar.

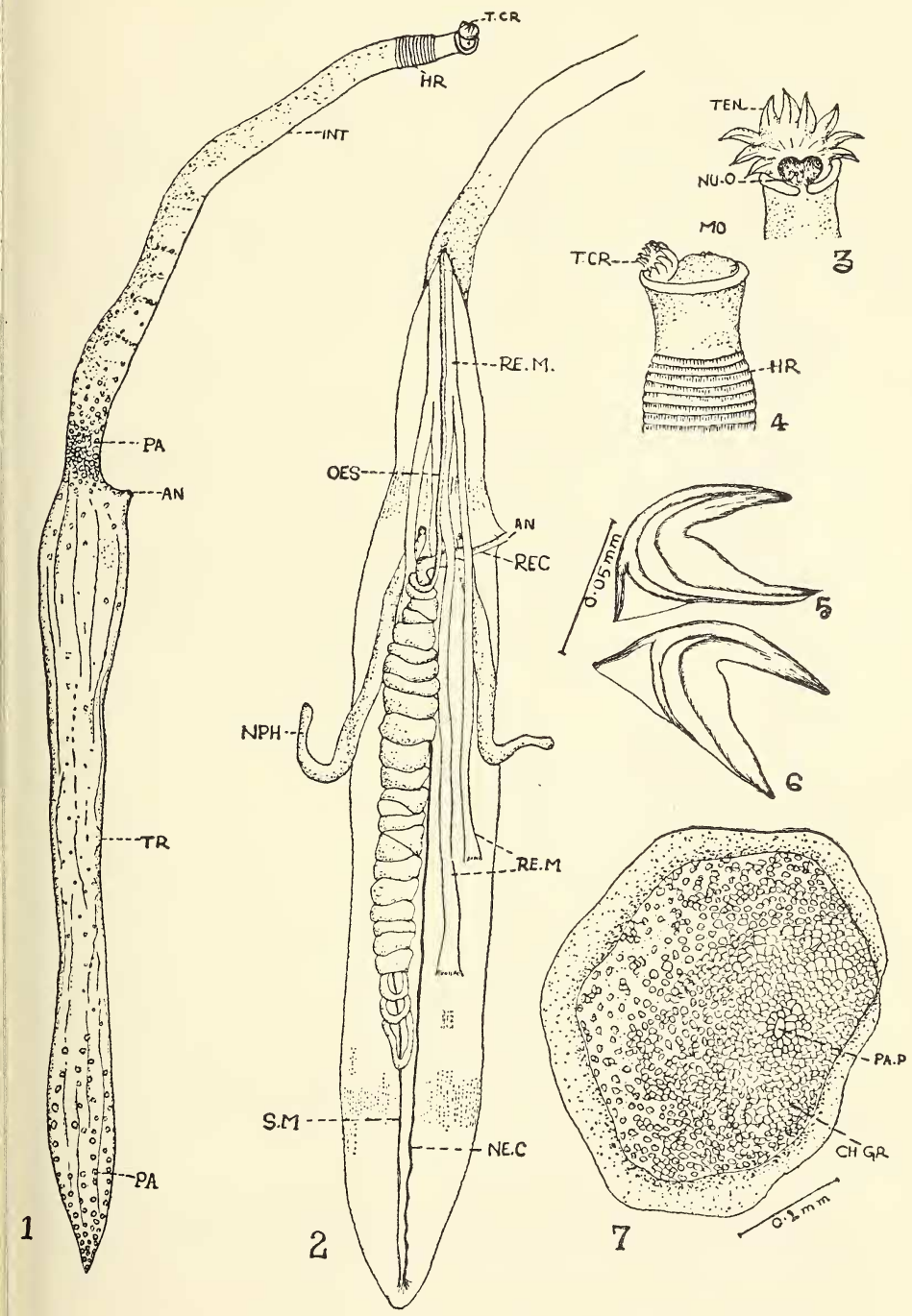
Distribution :

Mediterranean Sea, British Coasts, Coast of New England and Long Island, New York.

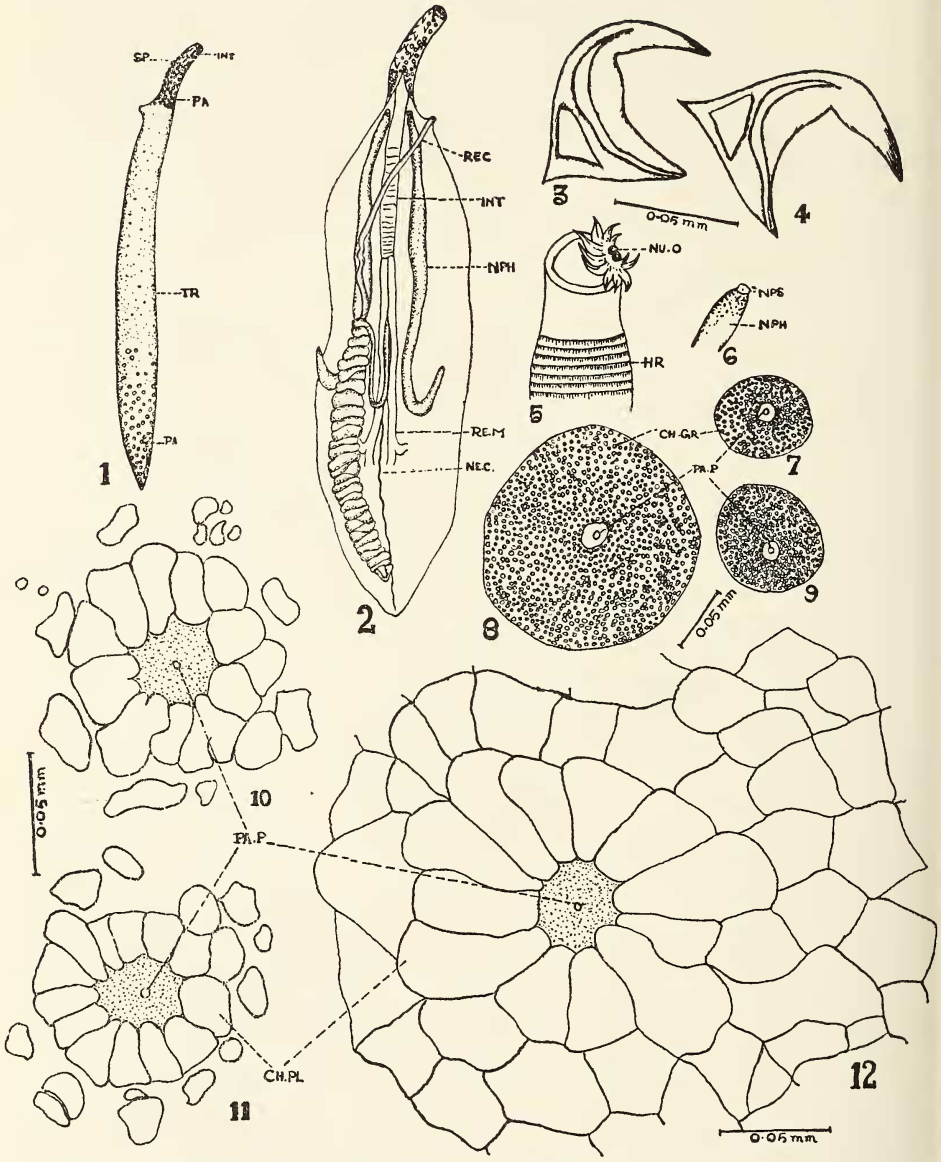
Description :

Slender and elongated forms, the trunk varying in length from 85 to 260 mm. Introvert considerably shorter than the trunk measuring only 15 to 50 mm. in length. The maximum width of the body varies from 6 to 8 mm. (Pl. III, Fig. 6). Body wall thick and opaque, and smooth in appearance. However, under magnification numerous minute and round papillae are seen distributed densely all over the trunk and the introvert. The introvert is not distinctly marked off from the trunk. The anus is located on the dorsal side of the animal about 3 mm. below the base of the introvert. The two nephridial openings can be observed on the ventral side, at the anterior region of the trunk. The introvert carries a well developed tentacular crown at its tip (Pl. III, Fig. 11). The tentacles are numerous and filiform and are arranged in a double series of folds. All the folds are continuous. Each fold contains about 15 to 20 tentacles. The mid-dorsal fold extends nearly to the mouth forming a loop to enclose the well developed nuchal organ. The tentacles are grooved on the oral side.

The longitudinal muscle layer of the trunk wall is separated into longitudinal bands. The number of bands varies considerably from specimen to specimen and even in the same specimen at different regions. In a single specimen, it varies from 36 to 42 and it is mainly due to the tendency of the bands to anastomose. In the introvert region the longitudinal muscle layer is continuous. There are four retractor muscles which are thin and slender. The dorsals are attached to the body wall anteriorly to the ventrals, and reach the anterior one-fifth of the trunk-length while the ventrals extend up to two-fifths of the trunk-length. The dorsals merge with the first and fifth longitudinal bands and the ventrals the eighth to fifteenth. At the introvert region, the ventrals and the dorsals fuse to form single bands, which finally fuse again to form a single stout band. On the dorsal aspect of this stout band runs the oesophagus, the latter being attached to it by mesenteries. Nephridia are two in number. They are brownish, long, tubular and free from the body wall in their entire length. The nephrostome is fan-shaped, frilled marginally and comparatively inconspicuous (Pl. III, Fig. 9). The two nephridia open ventrally at the same level, but far anteriorly to the anal opening. The loop of the alimentary canal does not even reach half of the trunk length. The intestinal coils vary from 60 to 64, and coil round a spindle muscle which is not attached to the posterior part of the trunk. The spindle muscle arises near the anus, runs along the rectum, very close to the rectal caecum and enters the intestinal coils as a thin strand and finally merges with the last coil of the intestine. The



Figs.: 1. *Phascolosoma andamanensis* sp. nov.; 2. Dissected; 3. Tentacular crown with nuchal organ; 4. Anterior region of the introvert; 5 & 6. Hooks from the introvert; 7. Papillae.



Figs. : 1. *Phascolosoma spinosum* sp. nov. ; 2. Dissected ; 3 & 4. Hooks from the introvert; 5. Anterior region of the introvert; 6. Nephridium anterior region; 7, 8 & 9. Papillae; 10, 11 & 12. *Phascolosoma antillarum* Grube & Oersted—Papillae.